Experiment NO: 01

Experiment Name: Implementation of Basic Network Topology.

Theory:

Network topology refers to the structured arrangement and interconnection of devices such as computers, switches, routers, and other nodes within a communication network. It plays a critical role in determining how data is transmitted, managed, and accessed across the network infrastructure.

Topologies are generally classified into two categories:

- **Physical topology:** Describes the actual physical layout of cables, hardware components, and nodes.
- **Logical topology:** Represents the way data flows through the network, regardless of its physical design.

The choice of network topology directly influences key performance factors such as scalability, fault tolerance, manageability, and cost-efficiency. The most widely implemented topologies include: Star, Tree, Mesh, Bus, Ring, and Hybrid, each offering specific advantages and limitations depending on the use case.

1. **Bus Topology :** In this topology, all devices share a single backbone cable. It is cost-effective for small networks but is susceptible to data collisions and backbone failures.

2. **Mesh Topology :** Each device is connected to every other device, providing high reliability and security. However, it is expensive and complex to implement.

3. **Star Topology :** All devices are connected to a central hub or switch. This configuration is easy to manage; however, failure of the central hub results in network downtime.

4. **Ring Topology :** Devices are connected in a closed loop, with data traveling in a single direction. A single break in the ring can disrupt the entire network.

5. **Tree Topology :** A hierarchical topology that integrates multiple star topologies. It is scalable, though failures in upper-level nodes can impact large sections of the network.

6. **Hybrid Topology :** This topology combines two or more different topologies, such as star and bus. It offers flexibility and robustness but involves higher complexity and cost.

Tools or Components:

1. Cisco Packet Tracker.
2. Desktop/Laptop.
3. Cable.
4. Switch-PT.
5. Hub-PT.

Procedure:

Task-1: Bus, Mesh, Ring and Tree Topology.

1. Place three Switch-PT devices in the workspace. Connect two PCs to each switch using straight-through Ethernet cables. Each switch should be connected to only one other switch to form a linear structure resembling a bus topology.

2. Assign a unique Class C IPv4 address (e.g., 192.168.1.0) to each PC. The default subnet mask (255.255.255.0) will be automatically applied. Rename each PC using its IP address to ensure clarity and uniqueness.

3. Test the bus topology by sending messages between different PCs. A successful message transfer confirms correct configuration.
4. Place seven Switch-PT devices for the tree topology. Connect one PC to each switch, except Switch 4, which should be connected to two PCs. Arrange the switches hierarchically, ensuring that each switch has a maximum of two child switches.
5. Repeat the IP configuration process as done in Step 2. Assign unique IP addresses to each PC and verify connectivity by testing communication between nodes

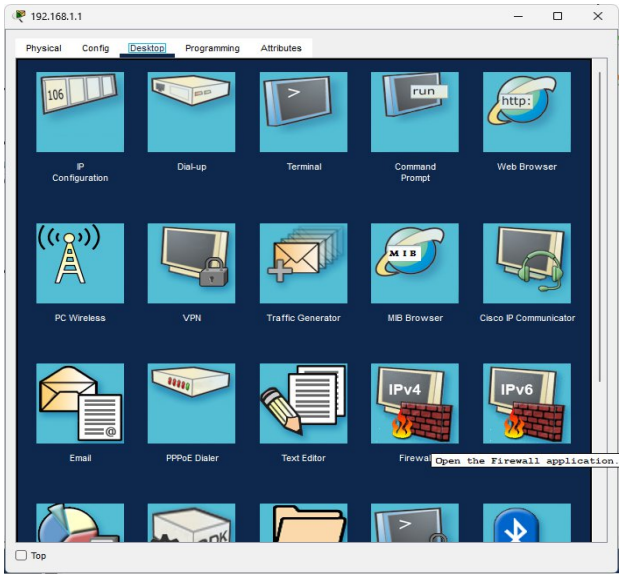


Figure-01: Desktop Interface

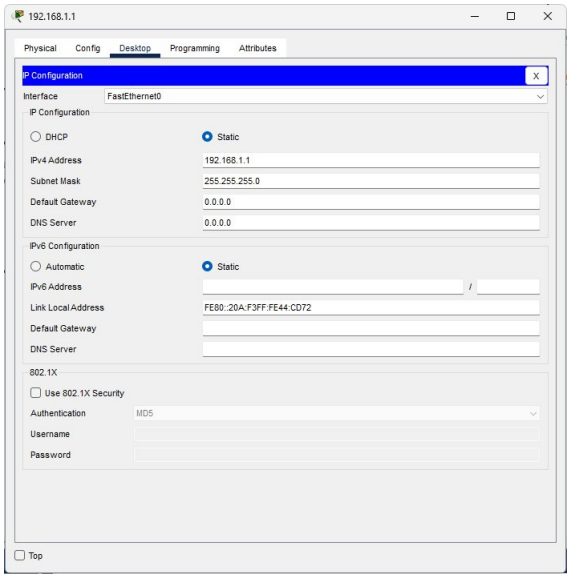


Figure-02: Imputation of IP Address

6. For the ring topology, place four Switch-PT devices and connect one PC to each switch. Interconnect the switches so that each one connects to exactly two other switches, forming a closed loop.
7. Assign IP addresses and test the network. Ensure that data can circulate through the ring without interruption.
8. For mesh topology, place four Switch-PT devices and connect one PC to each switch. Ensure that every switch is directly connected to all other switches.
9. Configure IP addresses and test all possible communication paths between PCs to confirm full connectivity in the mesh topology.
10. After completing all designs, verify the performance of each topology by sending messages between PCs. If communication fails, troubleshoot and correct any wiring or addressing issues. Ensure every PC can reach every other PC as per the expected behavior of its respective topology.

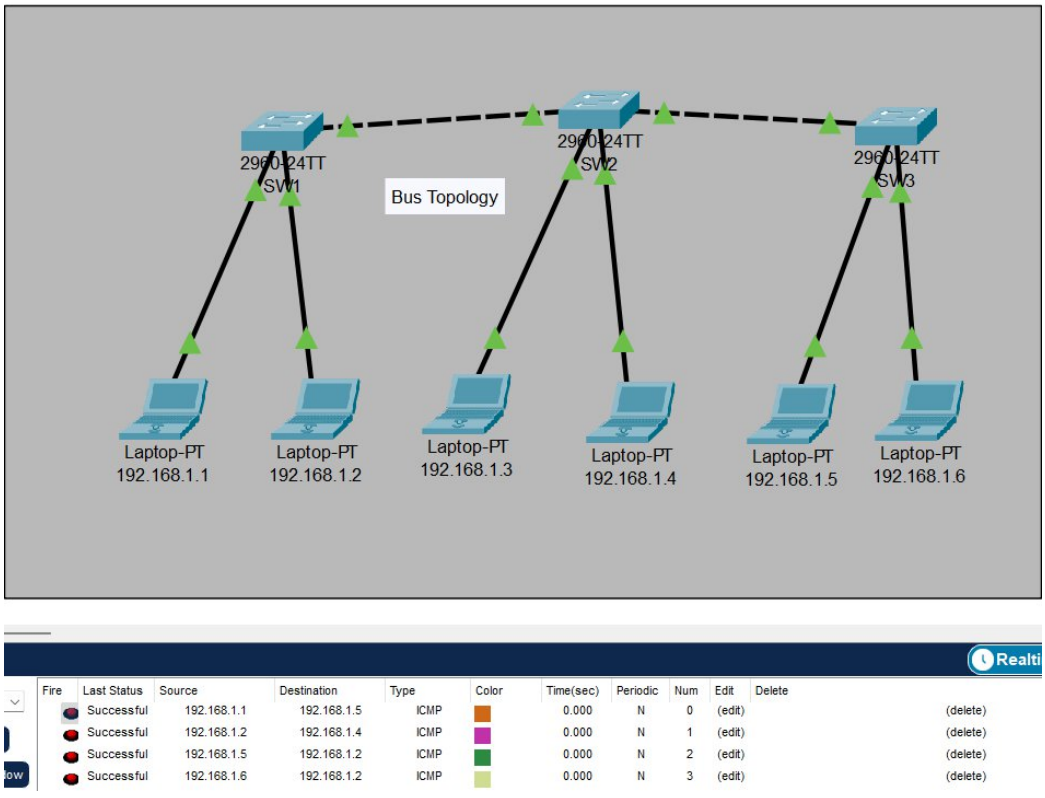
IP Configuration:

Bus Topology : 192.168.1.1, 192.168.1.2, 192.168.1.3, 192.168.1.4, 192.168.1.5, 192.168.1.6

Ring Topology : 192.168.1.12, 192.168.1.13,192.168.1.14,192.168.1.15

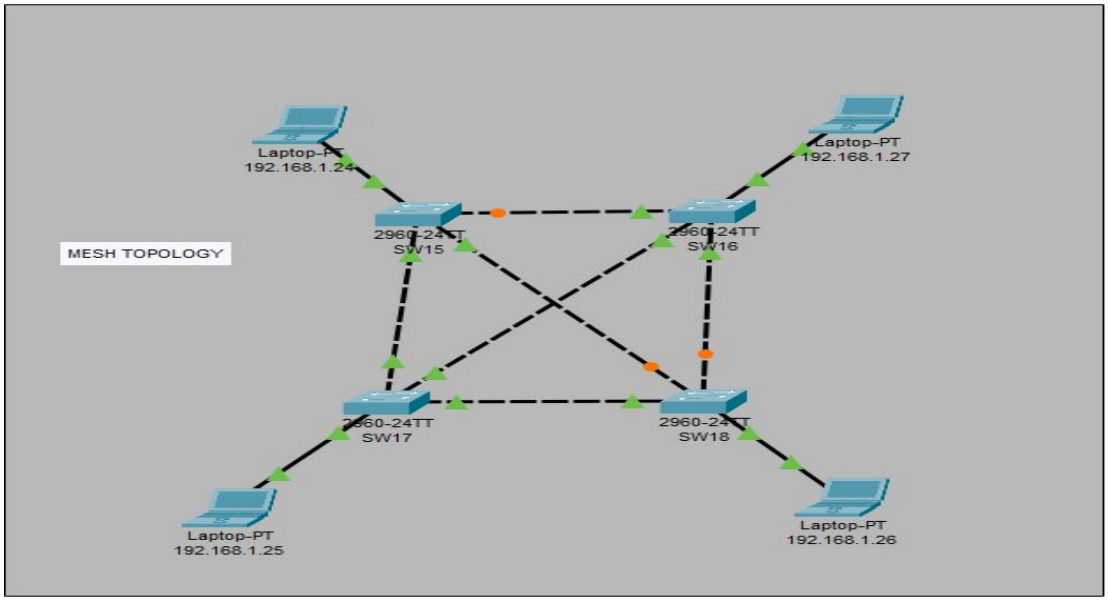
Mesh Topology : 192.168.1.24,192.168.1.25,192.168.1.26,192.168.1.27

Tree Topology : 192.168.1.16, 192.168.1.17, 192.168.1.18, 192.168.1.19, 192.168.1.20, 192.168.1.21, 192.168.1.22, 192.168.1.23



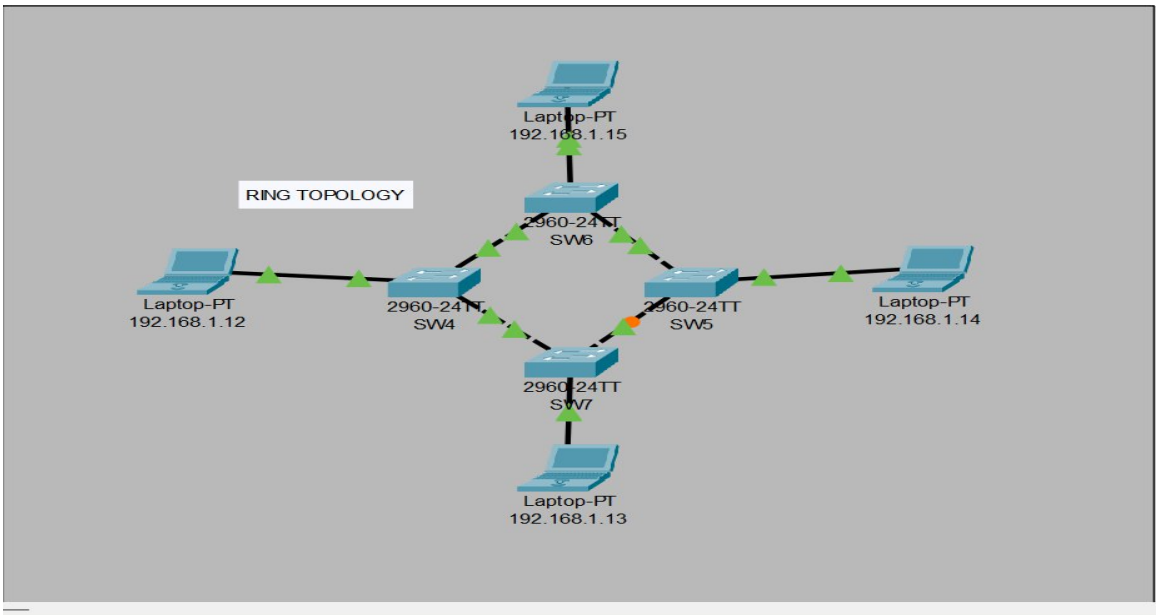
Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	192.168.1.1	192.168.1.5	ICMP		0.000	N	0	(edit)	(delete)
	Successful	192.168.1.2	192.168.1.4	ICMP		0.000	N	1	(edit)	(delete)
	Successful	192.168.1.5	192.168.1.2	ICMP		0.000	N	2	(edit)	(delete)
	Successful	192.168.1.6	192.168.1.2	ICMP		0.000	N	3	(edit)	(delete)

Figure-03: Bus Topology



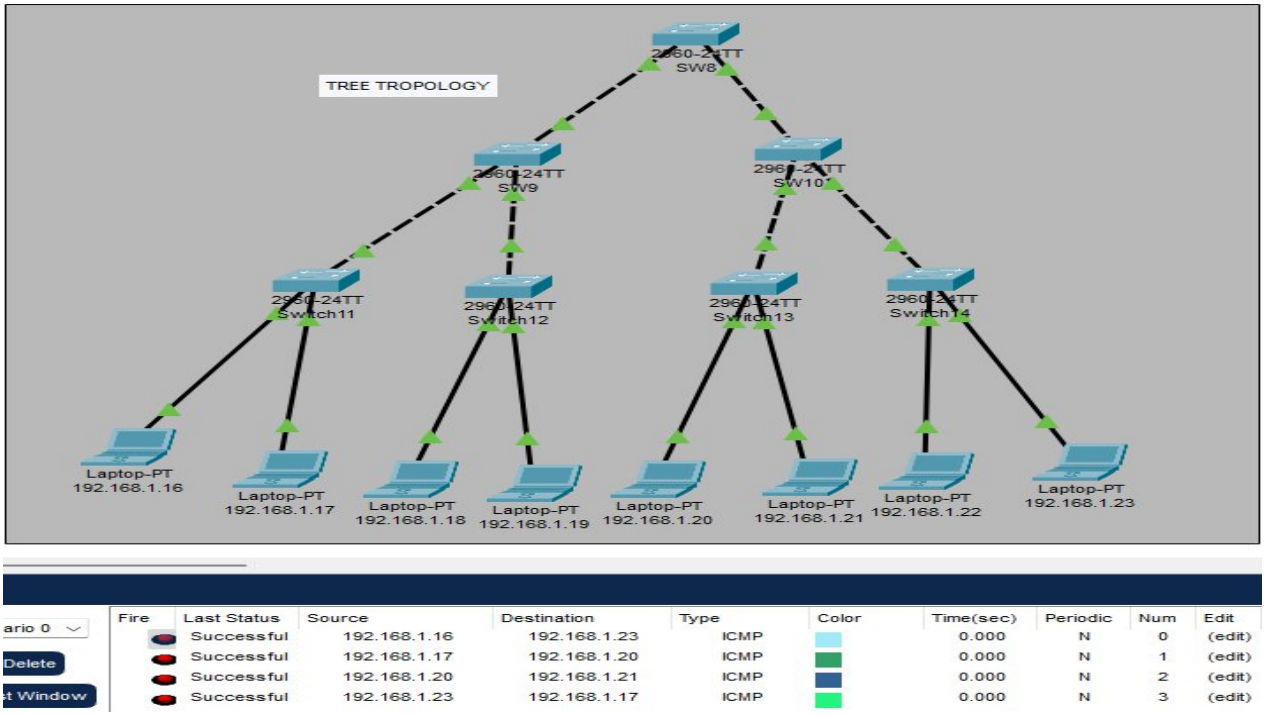
ire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit
	Successful	192.168.1.24	192.168.1.26	ICMP		0.000	N	0	(edit)
	Successful	192.168.1.25	192.168.1.27	ICMP		0.000	N	1	(edit)
	Successful	192.168.1.24	192.168.1.25	ICMP		0.000	N	2	(edit)
	Successful	192.168.1.27	192.168.1.26	ICMP		0.000	N	3	(edit)

Figure-04: Mesh Topology



Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	192.168.1.12	192.168.1.14	ICMP		0.000	N	0	(edit)	
	Successful	192.168.1.15	192.168.1.13	ICMP		0.000	N	1	(edit)	
	Successful	192.168.1.12	192.168.1.13	ICMP		0.000	N	2	(edit)	
	Successful	192.168.1.14	192.168.1.15	ICMP		0.000	N	3	(edit)	

Figure-05: Ring Topology



Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit
	Successful	192.168.1.16	192.168.1.23	ICMP		0.000	N	0	(edit)
	Successful	192.168.1.17	192.168.1.20	ICMP		0.000	N	1	(edit)
	Successful	192.168.1.20	192.168.1.21	ICMP		0.000	N	2	(edit)
	Successful	192.168.1.23	192.168.1.17	ICMP		0.000	N	3	(edit)

Figure-06: Tree Topology

<u>Task-2</u>: Star Topology.

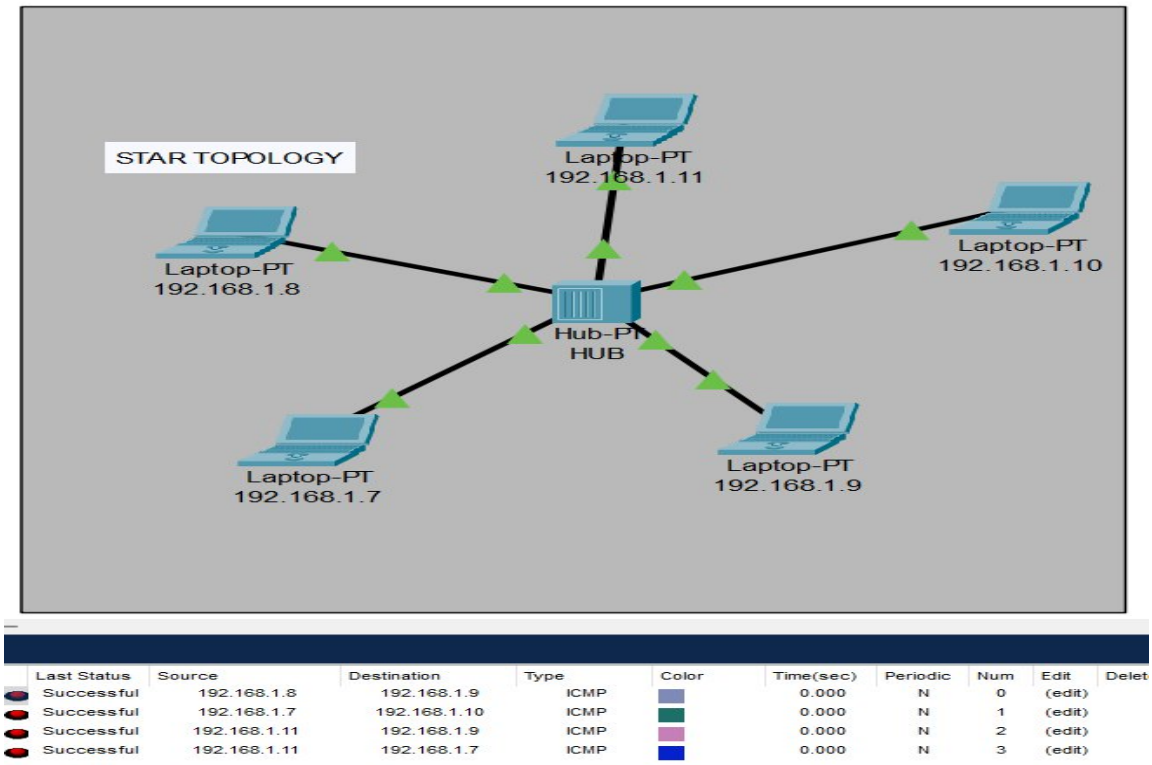
1. Place one Hub-PT device in the workspace. Connect five PCs to the hub using straight-through Ethernet cables to form the star topology.
2. Assign a unique Class C IPv4 address (e.g., 192.168.1.8) to each PC. The default subnet mask (255.255.255.0) will be applied automatically.
3. Ensure each PC is given a unique name, preferably based on its IP address, for easy identification.
4. This completes the star topology design.
5. Test the network by sending messages from one PC to another. If messages are delivered successfully, the network is functioning correctly. If not, identify and resolve the issue. Each connection should be tested to confirm there are no faults in the topology.

<u>Device</u>: Hub-PT, Laptop.

<u>IP Configuration:</u>

<u>Star Topology:</u>

192.168.1.7, 192.168.1.8, 192.168.1.9, 192.168.1.10, 192.168.1.11



Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delet
Successful	192.168.1.8	192.168.1.9	ICMP		0.000	N	0	(edit)	
Successful	192.168.1.7	192.168.1.10	ICMP		0.000	N	1	(edit)	
Successful	192.168.1.11	192.168.1.9	ICMP		0.000	N	2	(edit)	
Successful	192.168.1.11	192.168.1.7	ICMP		0.000	N	3	(edit)	

Figure-07: Star Topology

<u>Task-3</u>: Hybrid Topology.

1. Begin by designing the Bus, Star, and Ring topologies individually, following the same steps as in their respective configurations.
2. Once the three topologies are constructed, connect them together to form a hybrid topology. This is done by linking one switch or hub from each topology to another using Ethernet cables.
3. Specifically, connect one switch from the Bus topology to one switch from the Ring topology. Then, connect one switch from the Ring topology to the central hub used in the Star topology. This forms a basic hybrid structure combining the three topologies.
4. Note that hybrid topology can be designed in various ways; the method described here is one possible implementation.
5. After completing the connections, verify the network's functionality by sending messages between PCs located in different topologies. If messages are successfully delivered, the hybrid network is functioning correctly. If not, identify and resolve any faults. Test all possible communication paths to ensure complete connectivity across the combined network.

Device: Hub-PT, Switch-PT, Laptop.

IP Configuration:

Hybrid Topology:

192.168.1.28, 192.168.1.29,192.168.1.30,192.168.1.31,192.168.1.32, 192.168.1.33,192.168.1.34, 192.168.1.35,192.168.1.36,192.168.1.37, 192.168.1.38,192.168.1.39,192.168.1.40,192.168.1.41,192.168.1.42

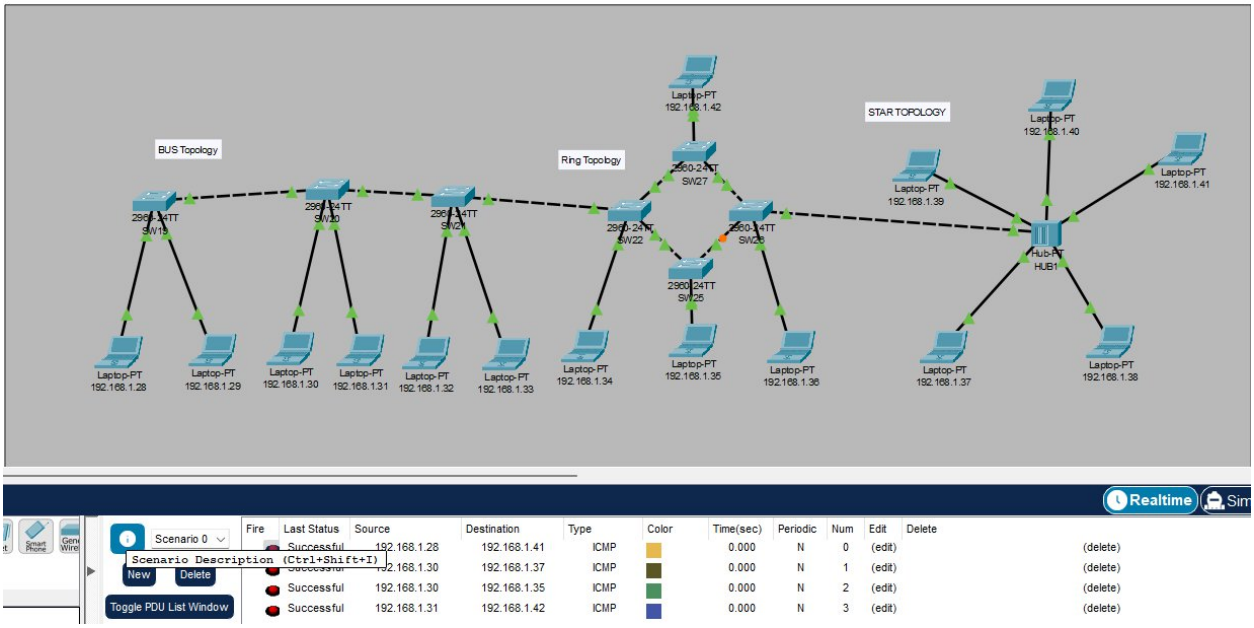


Figure-08: Hybrid Topology

Conclusion:

The objective of this lab was to implement and understand various basic network topologies using **Cisco Packet Tracer**. During the session, we configured different network components such as PCs, switches, and hubs, assigned IP addresses, and verified connectivity through message testing.By designing and analyzing multiple topologies including **star, tree, mesh, bus**, **ring,** and **hybrid**. We observed how each structure influences data flow, fault tolerance, and network efficiency. The lab provided valuable practical insight into the relationship between network layout and performance.This exercise not only strengthened our understanding of theoretical networking concepts but also demonstrated the significance of topology selection in building reliable and scalable networks.